Final Report

Arizona Grain Research and Promotion Council

August, 2003

Small Grain Advisory

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University of Arizona

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TITLE: Small Grain Advisory

INVESTIGATOR: *Mike Ottman*, Extension Agronomist, Univ. of Arizona

DURATION: November, 2002 to November, 2003

BACKGROUND: Cooperative Extension has a history of sending advisories to their clientele. Examples include the Alfalfa Report and Cotton Advisory. These mailings help growers make crop management decisions. Interest in a small grain advisory has been expressed.

OBJECTIVES: Develop and distribute a bi-weekly Small Grain Advisory.

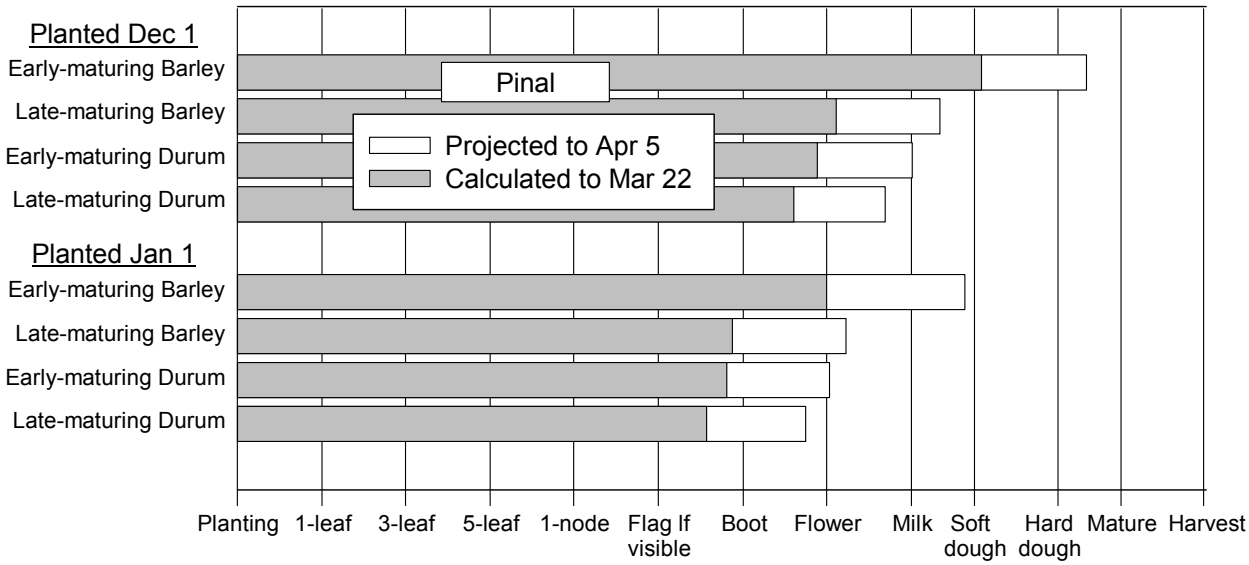
DESCRIPTION OF THE WORK: A Small Grain Advisory was developed for Yuma, La Paz, Mohave, Maricopa, Pinal, Pima, Graham, and Cochise Counties and distributed on a bi-weekly basis through County Cooperative Extension Offices. The advisories began in January and ended in May, depending on the location (Table 1). The advisories contain information on crop growth stage and water use throughout the season. Weather data from AZMET previously developed equations were used to estimate crop growth stage and water use.

RESULTS: About 10 Small Grain Advisories for 12 locations (see table below) were developed and mailed through Extension mailing lists. Publications were also developed and mailed on how to use the Small Grain Advisory for determining growth stage of a particular variety, when to irrigate, and when to initiate other management operations (see attached documents). In addition to being mailed, the advisories were also posted on my website (http://ag.arizona.edu/forageandgrain/smalladv.html). An example advisory is attached.

County	Location	Beginning date	Ending date	Number of Advisories
Yuma	Roll	Jan 12	May 18	10
	Yuma Valley	Jan 12	May 18	10
La Paz	Parker	Jan 12	May 18	10
Mohave	Mohave	Jan 12	May 18	10
Maricopa	Paloma	Jan 12	May 18	10
	Buckeye	Jan 12	May 18	10
	Harquahala	Jan 12	May 18	10
	Queen Creek	Jan 12	May 18	10
Pinal	Pinal	Jan 12	May 18	10
Pima	Marana	Jan 12	May 18	10
Graham	Safford	Jan 12	Jun 1	8
	Bonita	Feb 23	Jun 1	11

Pinal Small Grain Advisory
Mar 23, 2003

Crop Development



Crop Water Use

Location	Planting date	Crop	Variety	Water use (inches) Calculated Mar 9 – Mar 22	Water use (inches) Projected Mar 23 – Apr 5
Pinal	Dec 1	Barley	Early	2.48	3.50
			Late	2.24	3.34
		Durum	Early	2.28	3.43
			Late	2.22	3.36
	Jan 1	Barley	Early	1.91	3.04
			Late	1.62	2.60
		Durum	Early	1.67	2.64
			Late	1.62	2.57

Effective **rooting depth** on Mar 22 and Apr 5 is estimated at 46 and 48 inches for a Dec 1 planting and 38 and 46 inches for a Jan 1 planting. **Precipitation** between Mar 9 and Mar 22 totaled 0.39 inches.

(Note: This advisory was developed by Mike Ottman, Agronomist, University of Arizona with AZMET weather data and funded by Arizona Cooperative Extension and the Arizona Grain Research and Promotion Council.)

How to use the Small Grain Advisories to Determine Variety Growth Stage

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The Small Grain Advisories provide estimates of crop development (growth stage) and water use for early and late varieties of barley and durum. The "check" varieties that these various maturity groups were modeled after are: 1) Early barley = Barcott, 2) Late barley = Gustoe, 3) Early durum = WestBred 881, and 4) Late durum = Duraking. To determine the crop developmental stage of a particular barley or durum variety, use the tables below to compare the difference in days to heading and maturity of the variety of interest to the "check" variety. Varietal developmental differences are not significant until about the 1-node stage.

Heading and maturity of barley varieties compared to "Early barley" (Barcott) and "Late barley" (Gustoe).

		Days difference from "Early barley" (Barcott)		Days difference from "Late barley" (Gustoe)	
Variety	Breeder[1]	Heading	Maturity[2]	Heading	Maturity[2]
Barcott	WPB	0	0	-17	-15
Mucho	APB	5	8	-12	-7
Baretta	APB	12	15	-5	0
Nebula	WPB	12	15	-5	0
Commander	WWW	15	16	-2	1
Gustoe	WPB	17	15	0	0
Max	WWW	19	21	2	6

[1] Breeder: APB = Arizona Plant Breeders, WPB = Western Plant Breeders, WWW = World Wide Wheats.
[2] Maturity: Physiological maturity, which is 1-2 weeks before harvest ripe stage.

Heading and maturity of durum varieties compared to "Early durum" (WPB 881) and "Late durum" (Duraking).

		Days difference from "Early durum" (WPB 881)		Days difference from "Late durum" (Duraking)	
Variety	Breeder[1]	Heading	Maturity[2]	Heading	Maturity[2]
Tacna	WPB	-4	-1	-8	-4
Kronos	APB	-1	0	-5	-3
Sky	APB	0	---	-4	---
WPB 881	WPB	0	0	-4	-3
Kofa	WPB	1	3	-3	0
Mohawk	WPB	1	2	-3	-1
Ocotillo	APB	1	1	-3	-2
Matt	APB	2	---	-2	---
Bravadur	WWW	3	2	-1	-1
Deluxe	WWW	4	2	0	-1
Duraking	WWW	4	3	0	0
Platinum	WWW	4	2	0	-1
Crown	WWW	5	5	1	2
Ria	WWW	5	2	1	-1
Orita	WPB	7	5	3	2
Topper	WWW	7	6	3	3

[1] Breeder: APB = Arizona Plant Breeders, WPB = Western Plant Breeders, WWW = World Wide Wheats.
[2] Maturity: Physiological maturity, which is 1-2 weeks before harvest ripe stage.

Irrigation Management Using the Small Grain Advisory

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The Small Grain Advisory can be used as an aid for decisions regarding irrigation amount and timing. Crop water use estimates provided by the advisory, divided by an irrigation efficiency, can serve as a guideline for the amount of irrigation water that should be applied, particularly with drip or sprinkler irrigation systems. With flood or furrow systems, the advisory is more useful for irrigation timing since the minimum amount of water applied by these systems is usually more than the amount needed.

The Small Grain Advisory can be used to schedule small grain irrigation using the Water Balance Method. This method involves estimating soil water depletion as the difference between crop water use and effective rainfall, and irrigating when soil water depletion in the active root zone reaches a critical level. The Advisory provides crop water use and rooting depths for 2-week periods. The maximum allowable soil water depletion is usually set around 50% of available water holding capacity for small grains, but may be decreased to 35% if water is inexpensive, or may be increased to 65-80% before jointing or after soft dough due to increased resistance to water stress at these stages. Available water holding capacity varies according to soil texture (see table below). A period of 2 days is usually allowed after irrigating before water use is summed to account for drainage.

Available water holding capacity for various soil types averaged from Arizona soil survey information.

Soil texture	Available water holding capacity (inches/ft)
Sand	0.85
Sandy loam	1.38
Sandy clay loam	1.73
Loam	1.94
Silty clay loam	2.30

Example - Critical depletion level

Calculate the critical depletion level of available water holding capacity given the following:

1) Available water holding capacity = 1.73 inches/ft (sandy clay loam),
2) Active rooting depth = 3.0 feet,
3) Maximum allowable depletion = 50% or 0.50.

Critical depletion level

= (Available water per ft) x (rooting depth in ft) x (maximum allowable depletion)

= (1.73 inches/ft) x (3.0 ft) x (0.5) = 2.6 inches

Example – Soil water depletion

Calculate soil water depletion from the most recent irrigation through Feb 28 given the following:

1) The most recent irrigation was applied on Feb 1,
2) Water use from Feb 1 – 14 is 1.12 inches (0.08 inches/day),
3) Water use from Feb 15 – 28 is 1.40 inches (0.10 inches/day),
4) 0.2 inches of rainfall was recorded on Feb 21.

Soil water depletion

= (Crop water use [excluding 2 days after an irrigation]) – (effective rainfall)

= $(0.08 \text{ inches/day} \times 12 \text{ days})_{\text{Feb 1-14}} + (1.4 \text{ inches} - 0.2 \text{ inches rain})_{\text{Feb 15-28}}$

= 2.16 inches

How to Use the Small Grain Advisories for Timing of Management Operations

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The small grain advisories can be used as an aid in planning management operations based on crop growth stage. The growth stage estimated by the small grain advisories should always be verified for the fields in question.

Stand evaluation. Stands and soil conditions should be evaluated between emergence and the 2-leaf stage. If soil crusting is hindering emergence, a light irrigation may be warranted. An adequate stand is approximately 20 plants per square foot, but yields may not suffer greatly if stands are much less if the plants are uniformly distributed. The yield difference associated with a later planting should be considered before replanting.

Weed control. Weed control failures are often associated with applying a herbicide too late. Therefore, scout for weeds early, and apply a herbicide at the proper developmental stage of the crop and weed.

Insect control. The only insect that normally needs to be controlled on small grains is aphids on barley. These insects usually do not appear until jointing, and if they appear after heading, control is not necessary. Natural enemies are often effective in reducing aphid populations.

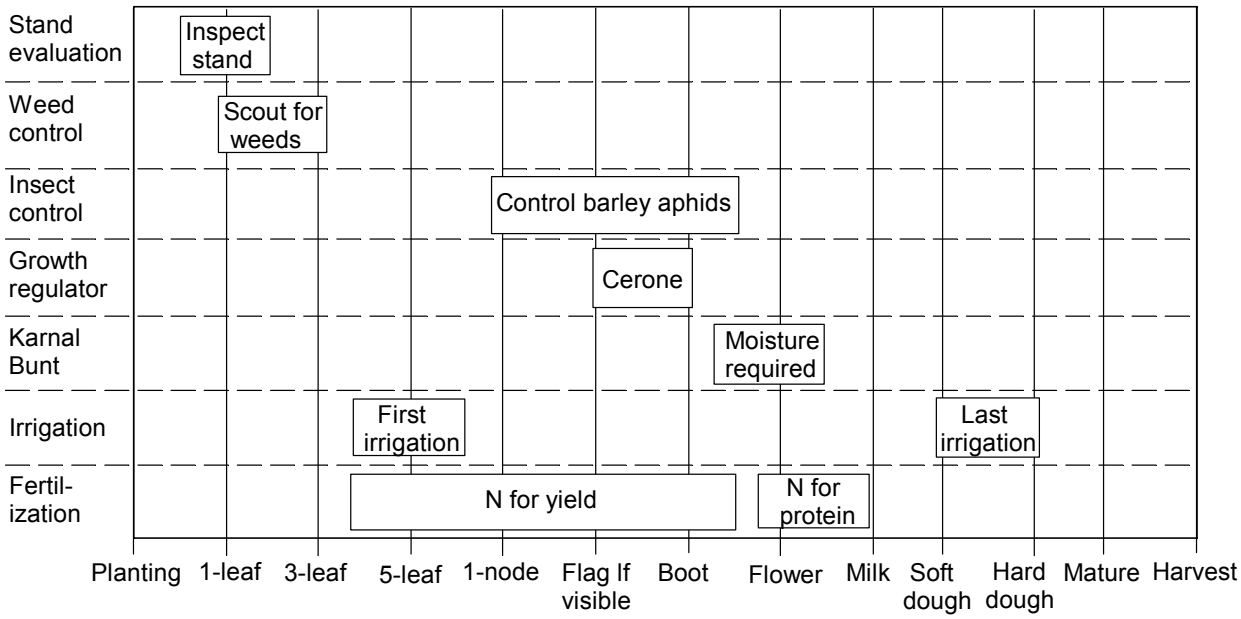
Cerone. Cerone is a plant growth regulator used to control height and reduce lodging in small grains. This chemical should be applied between the flag leaf visible stage and boot to be most effective.

Karnal bunt. Wet conditions between awn emergence and the end of flowering are critical for the development of this disease.

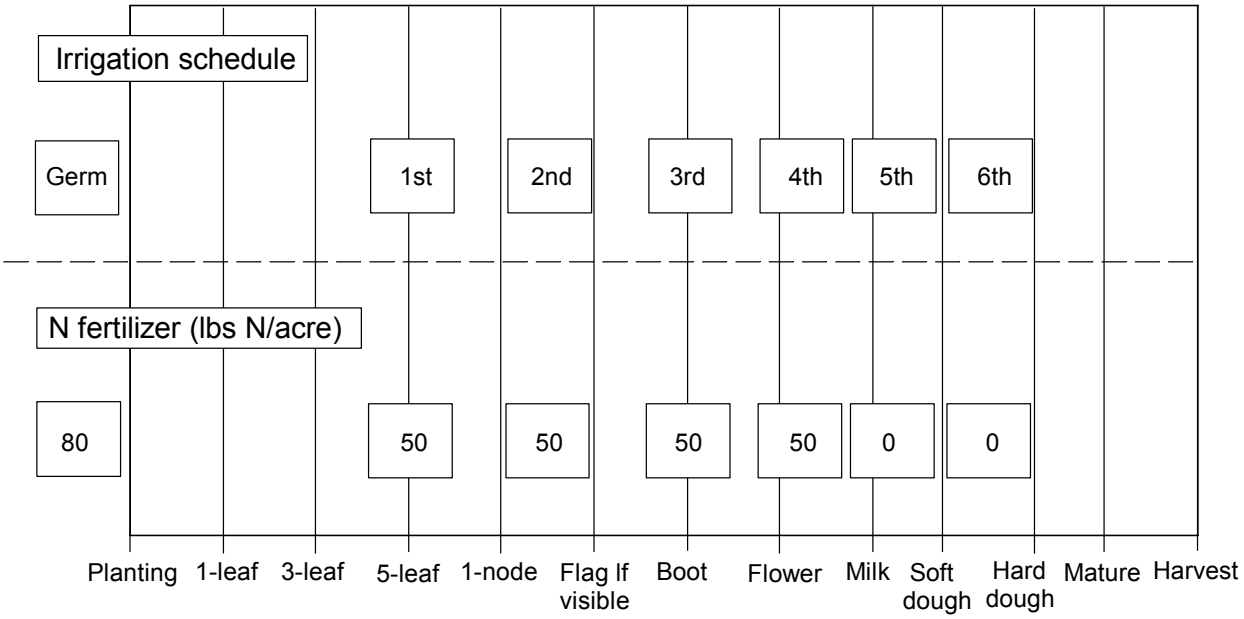
Irrigation. The first irrigation is usually not needed until about the 5-leaf stage. The soonest the last irrigation can be applied on most soils is the soft dough stage, and in practice the last irrigation may be applied between soft dough and hard dough depending on the irrigation cycle.

Nitrogen fertilizer. Nitrogen fertilizer applied before heading affects yield primarily, and that applied between heading and about 2 weeks after flowering is most effective in increasing grain protein content. Nitrogen fertilizer may be applied at planting time, and in each irrigation until heading for barley or until the milk stage in wheat.

Timing of management operations using crop developmental stage



Example irrigation and N fertilizer schedule for durum on a sandy clay loam soil



Small grain herbicide timing based on crop developmental stage